TECHNICAL WORK MAY NOT BEGIN PRIOR TO CO APPROVAL NASA/GODDARD SPACE FLIGHT CENTER Page 1 of 14 REQUEST FOR TASK PLAN / TASK ORDER NAS5-TASK NO. AMENDMENT QSS Group, Inc. 99124 567-315-90-14-89 00 TASK TITLE: (NTE 80 characters; include Project name NASA Search and Rescue Program Services APPROVALS AND TYPE OF PURE NAME AND AGOD ASSISTANT TECHNICAL REPRESENTATIVE (OR TASK MONITOR) PHONE ORG 7-21-00 FOR DA David W. Affens 567 480 301-286-9839 BRANCH HEAD CODE PHONE 7-21-00 John Chitwood 567 301-286-7665 CONTRACTING OFFICER'S TECHN CODE pv^C Robert S. Lebair, Jr. 560 301-286-6588 FLIGHT HARDWARE, CRITICAL GSE OR SOFTWARE CONTRACTING OFFICER'S QUALITY REP DESIGNATED FAM: [X] NO [] YES The contractor shall identify and explain the reason for any deviations, exceptions, (To be completed by Contracting Officer) C.O. Requested Quote on: or conditional assumptions taken with respect to this Task Order or to any of the technical requirements of the Task Order Statement of Work and related specifications. Date: .1111 2 4 2000 The contractor shall complete and submit the required Reps and Certs. Contractor will develop specification or statement of work under this task for a future procurement. [X] NO [] YES Flight hardware will be shipped to GSFC for testing prior to final delivery. [] YES Government Furnished Property/Facilities: [] YES -- SEE LIST OF GFP (offsite only) / FACILITIES (onsite only) [X] NO Onsite Performance: [] YES If yes: [X] NO [] TOTAL If partial, indicate onsite work in SOW by asterisk (*) Surveillance Plan Attached: [X] NO [] YES Highlighted Contract Clauses: (to be completed by Contracting Officer) The effective date of this task order can be found at the Contracting Officer's signature box below. INCENTIVE FEE STRUCTURE (check one) (See Contract NAS5-99124, Attachment K, Incentive Fee Plan) X No. 1 No. 2 No. 5 No. 3 _ 25% 50% 10% 25% % Cost Schedule 15% 25% 25% 50% % 25% % Technical 75% 25% 50% The target cost of this task order is \$ 522,942 The target fee of this task order is \$ The total target cost and target fee of this task order as contemplated by the Incentive Fee clause of this contract is \$ 526,707 The maximum fee is \$ 5,503 The minimum fee is \$0. **ELIZABETH J. AUSTIN** CONTRACTING OFFICER

DATE

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NASSTASK NO.

AMENDMENT

99124

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Applicable paragraphs from contract Statement of Work:

STATEMENT OF WORK: (Continue on blank paper if additional space is required)

Expected start date is September 14, 2000.

See page 3.

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See page 10.

SECURITY:

This work may require access to classified information.

APPLICABLE DOCUMENTS:

None.

TASK END DATE:

9/30/01

MILESTONES/DELIVERABLES AND DATES:

See page 13.

PERFORMANCE STANDARDS:

Schedule:

On-time completion/delivery of milestones/deliverables

Technical: ATR's acceptance of the above

FINAL DELIVERY DESTINATION (NAME, BLDG, ROOM):

David W. Affens, building 6, room S218

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NASA Search and Rescue Program Services

BACKGROUND

The National Search and Rescue Plan¹ gives NASA the role of developing aerospace technology for application to search and rescue and related activities. The work carried out in performing this role includes technical consulting on matters concerning satellite-based distress alerting and locating systems, technical support for the operation of the Search and Rescue Satellite-Aided Tracking (Sarsat) and locating system, management of the implementation of the Sarsat space segment, development of air and spaceborne remote sensing techniques for aiding in searches, and support in the activities of the National Search and Rescue Committee and the International Cospas-Sarsat Program. In the conduct of this work, NASA relies on contractors who have a specialized background and experience in all areas of expertise applicable to the NASA search and rescue role.

OBJECTIVE

The objective of this task is to obtain the technical and operational assistance necessary for NASA to conduct research and development and the application of aerospace technology for the enhancement of national and international search and rescue capabilities.

¹ The National Search and Rescue Plan establishes the policy of the signatory agencies to provide a national plan for coordinating search and rescue services to meet domestic needs and international commitments. Signatories are the Department of Transportation, Department of Defense, Department of Commerce, the Federal Communications Commission, the National Aeronautic and Space Administration, the Department of Interior, the Federal Emergency Management Agency and certain State and local and civil organizations that have facilities that contribute to the effectiveness of the over-all search and rescue network.

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STATEMENT OF WORK

The scope of work to be performed will include concept development, system analysis, experiment planning and execution, program planning, cost estimation, cost/benefit analysis, program justification, policy formulation and technical meeting support including participation and support of standing and ad hoc committees and working groups on Search and Rescue. The scope of work will extend to a variety of search and rescue communication systems and hardware carried aboard orbiting spacecraft, aircraft, maritime vessels, and land vehicles, as well as fixed and ground based equipment. Technologies applied to search and rescue operations will include terrestrial and space communications, data communications, radar imagery collection and computer processing and analysis, signal processing and microelectronics.

The contractor will be expected to participate in, but not be limited to, some or all of the following support activities:

Assisting the NASA/GSFC Search and Rescue Mission Office in fulfilling NASA responsibilities as outlined in the National Search and Rescue Plan, Intergovernmental agreements, applicable Memorandum of Understanding and with activities associated with the National Search and Rescue Committee (NSARC) and it's ad hoc sub-committees.

Assisting the NASA/GSFC Search and Rescue Mission Office with understanding and coordinating activities within the National and International Search and Rescue structure including rescue coordination and rescue operations.

Providing the systems engineering necessary to develop of improved methods of using low orbit and geostationary satellites systems to detect and locate signals transmitted by emergency locator radio beacons which includes Doppler signal processing techniques.

Providing the systems engineering required to develop, fabricate, integrate and test spacecraft instruments.

Providing the systems engineering required to design prototype Emergency Locator Transmitters, Emergency Position Indicating Radio Beacons, and Personal Locator Beacons and devise, in coordination with rescue and survivor authorities (human factors), operational use procedures.

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Assisting in the processing of communications rule making that impacts search and rescue capabilities including the obtainment of frequency allocations for search and rescue experiments through the regulatory process.

Assisting in the collection and analysis of search and rescue data available from agencies such as the National Transportation Safety Board, United States Coast Guard and Air Force Rescue Coordination Centers, the Federal Communications Commission and the United States Sarsat Mission Control Center (USMCC) operated by NOAA.

Assisting with the application of synthetic aperture radar principles and associated image processing techniques that can be applied to the search for crashed aircraft that are hidden by foliage, obscured by weather, or both. The task will include the planning, coordination and execution of field experiments involving radar platform selection, site selection and material procurement.

Assisting with the potential use of the Global Positioning System (GPS) constellation as a platform for future search and rescue repeater instrumentation including the development of a prototype ground station and the development a new prototype two-way emergency transmitter. The work will include the preparation of appropriate briefings that will be given to members of the National Search and Rescue Committee and interested parties within the Department of Defense.

Providing for the development of agendas for international and national search and rescue meetings, to include the processing of NASA papers, to insure that they meet the standards appropriate for each meeting.

Assisting with the preparation of summarized proceedings of meetings, based on understanding of search and rescue subjects, the relationship of national and international organizations involved in the context of the meeting discussions.

Assisting Search and Rescue Mission Office representatives with meeting logistics on an as required basis, including meeting translation service, accommodations for international guests, social arrangements and the booking of appropriate meeting facilities.

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Specific Tasks:

1. The Application of Future Space Systems to Search and Rescue

Apply operational and technical expertise in the development and implementation of advanced computerized ground processing systems for the Search and Rescue Satellite-Aided Tracking (Sarsat) system, utilizing benefits from past development efforts and from national and international user experience. The contractor will be required to assist NASA/GSFC in the selection of a functional and reliable ground system

Evaluate new search and rescue aiding instruments based upon needs, methods and techniques in use and likely to be used by both military and civilian search and rescue communities. These instruments will utilize digitally recorded and real time computer processing equipment capable of being installed on aircraft and future spacecraft (host or dedicated).

Aid in the preparation of technical specifications needed for the implementation of future search and rescue aiding instruments including the next generation Sarsat ground and space segments. Technical specifications must meet both technical requirements as well as user requirements of the search and rescue community.

Participate in radio spectrum and frequency management activities as related to future search and rescue requirements, and include consideration of the roles of national and international regulatory and administrative agencies in their relationship to search and rescue.

Working in conjunction with Department of Defense search and rescue and GPS personnel: perform studies, analyses, and provide system engineering necessary to develop a civil Global Personnel Recovery System (GPRS) that will utilize future Global Positioning System (GPS) satellites as platforms for the Search and Rescue repeater instruments.

2. Evaluation of the Current Sarsat Space Segment

Evaluating of pre-launch and post-launch anomalous behavior of current and planned search and rescue space borne instruments.

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Evaluating newly launched search and rescue instruments to determine their operational readiness to support the search and rescue mission.

Mitigating of radio frequency interference that is impeding the efficient operation of search and rescue communication systems. The location of interfering emitters will be determined through the use of automated computer plotting techniques.

3. Complementary Communication Systems

Apply operational search and rescue techniques and advanced technology to develop approaches for the enhancement of the current satellite-aided search and rescue (Sarsat) program. Areas for development are improved communications, i.e., improved radio beacons, satellite repeaters, advanced computer processing, and the potential incorporation of commercial mobile satellite communication systems as an aid to search and rescue operations and disaster response.

Assist in the collection and analysis of search and rescue data from national agencies such as the National Transportation Safety Board, United States Coast Guard and Air Force Rescue Coordination Centers, and the United States Sarsat Mission Control Center operated by NOAA.

4. Identify, Develop and Implement Complementary Remote-Sensing Systems

Based on current airborne search and rescue experience, develop and evaluate remote sensing instruments/systems for use aboard search aircraft and/or low-orbit satellites for detecting and locating downed aircraft and distressed marine vessels and life preserving equipment in the absence of an operating distress beacon and radio communicating capability. Land searching will include the application of the latest techniques of foliage penetration and ice and snow penetration and automatic target recognition. Integration of the sensor and equipment onto cost effective and available aircraft will be considered, based on recent experience that has contributed to the state of the art for practical applications. Extrapolation of an airborne system to a satellite system will also be evaluated. Evaluation of computer generated images will be required to determine their applicability to search and rescue mission use.

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Evaluate remote sensing systems by conducting field experiments involving remote-sensing instruments and simulated distress incident scenes based on search and rescue actual scenes, scenarios and operations. Work includes selection of experiment locations, purchasing of support materials, coordination with local and national authorities, obtaining appropriate distress incident targets and coordinating the participation of the required remote sensing platforms.

In cooperation with potential operational users, develop, test and critique procedures and techniques for the application of remote sensing equipment to the search and rescue mission. Using the latest techniques developed by in-the-field search and rescue operators, develop techniques and specify products using the remote sensing system, for search area selection, search map production, tracking of search and rescue resources and analysis of search area coverage. Test these techniques and collect user critique of the techniques. Desk top computer equipment and software programs will also be evaluated for potential field use during search and rescue missions.

Manage the upgrade of the synthetic aperture radar (SAR) processing of raw data into complex images, including special focusing of low frequencies (P-band and L-band) SAR data utilizing the latest techniques, and include the necessary attitude error compensation of the candidate platforms. Manage the upgrade of the processing of complex images of four polarimetry channels into finished polarimetric products, including processing of calibration target data and phase calibration. Develop polarimetry-based automatic target recognition methods for detection of downed aircraft sites, including the latest foliage penetration and snow and ice penetration target recognition. Included in these upgrades is the migration of computation-bound programs from the GSFC Cray computer to a search and rescue workstation, with a goal of portability of the final system. Processing of search and rescue field experiment data to analyze and evaluate performance of the system will be performed on this workstation system as part of this task.

5. New Technology for Search and Rescue

Through rapport with the active search and rescue community and collaboration with the military and intelligence communities dealing in remote sensing techniques, identify and develop new concepts and systems having the potential to improve search and rescue and disaster support operations.

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6. Distress Beacons

Interpreting and evaluating existing regulations that govern the design and use of distress beacons (comprising Emergency Locator Transmitters, Emergency Position Indicating Radio Beacons, and Personal locator Beacons) in the United States and assist NASA in developing positions on Notices of Proposed Rule Making that impact search and rescue.

Supporting the formulation of policy recommendations concerning distress beacons.

Identification and evaluation of new technology and/or regulations required to allow the production and use of advanced emergency beacons, including those developed by other agencies of the United States Government.

Planning, coordinating, and conducting field trails of prototype distress beacons and evaluating the results of these trials.

7. Information Technology and Colloquium Management

Using appropriate information technology, manage the current NASA Search and Rescue library and provide access to the NASA archived library. Based on NASA requests for information, search and retrieve documents from the NASA library and the appropriate libraries of the national and international regulatory, administrative, and search and rescue organizations, based on an understanding of the purpose, organization and inter-relationships of these organizations and their relation to search and rescue.

Manage the development of agendas for international and national search and rescue colloquia, organized by NASA such as the Cospas-Sarsat Committees and Working Groups, The International Maritime Organization, The International Civil Aviation Organization and the National Search and Rescue Committee and it's Working Groups. Manage the development of NASA papers, insuring that they meet the standards appropriate to each colloquium and manage the coordination and collection of all external papers for such colloquia hosted by NASA. Provide summarized proceedings of the colloquia, based on knowledge of the search and rescue subjects, the relationship of the national and international organizations involved and the context of the discussions. Manage colloquia logistics including: translation services, accommodation of any unique needs of international guests and locating and booking appropriate meeting places. Insure NASA participants

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understand and are prepared to appropriately participate in scheduled activities of any colloquia requiring international travel.

There is the expectation that a new international technical committee will be formed that would be administratively supported via this contract. The new committee, called the International Search and Rescue Technology Working Group, is intended to have annual meetings. The meeting location will alternate between the member countries.

8. Technical Support, Special Studies and Analyses

Participation in standing and ad hoc committees and working groups that develop standards, policy and search and rescue program planning at the national and international levels of government.

Providing technical experts as needed to support the NASA Search and Rescue Program. Support will include areas such as enhancement of existing systems, concept development, requirements analysis, system analysis, system engineering, experiment planning and execution, program planning, special studies, cost estimation, cost/benefit analysis, program justification, and policy formulation in support of the NASA Search and Rescue program.

PERFORMANCE SPECIFICATIONS:

Report on Advanced Sarsat Ground System: Report shall include the application of past national and international operational results with a review of state-of-the-art technology to propose and evaluate systems which enhance the Sarsat Mission while maintaining functionality and reliability. Clarity, in both an executive summary and background text, is important.

Report on Search and Rescue New Instrument Study: Report shall contain civilian and military unclassified state-of-the-art sensor technology that includes, but is not limited to, radar and laser based instruments. It should show how both airborne and space-borne hosting can be applied using search and rescue instruments to find crashed aircraft and distressed maritime vessels. Clarity, in both an executive summary and background text, is important.

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Report on Strategy for SAR² Radar Frequency Assignment: This report must include a strategy that is developed based on the roles of national and international regulatory and administrative agencies and their relationship to search and rescue. Clarity, in both an executive summary and background text, is important.

Report on GPRS Civil System Definition: This report must include recommendations on what is needed in terms of joint DOC/NASA cooperation, agreements and technical/programmatic information. These recommendations are necessary in helping to meet the GPS technical/program requirements and technical/programmatic information required for the parallel development of the civil and military portions of GPRS. Clarity, in both an executive summary and background text, is important.

Report on Advanced Sarsat Communications: This report must include proposals and an analysis of methods for using improved radio beacons, satellite repeaters, advanced computer processing and any innovative method that will make use of existing or soon to be established commercial mobile satellite communication systems. It should include any constraints of operational techniques currently in use and the advantages of newly recommended operational techniques to aid search and rescue operations and disaster response. Clarify, in both an executive summary and background text, is important.

Report on New Complementary Remote Sensing Search and Rescue Systems: This report should consider constraints and needs of a remote sensing system based on current airborne search and rescue experience. It should include an analysis of systems used in detecting and locating downed aircraft and distressed vessels in the absence of operating distress beacons and radio communications. The proposed system shall include foliage penetration, ice/snow penetration and state of the art automatic target recognition. Problems and solutions for satellite instrument hosting should be included. Clarify, in both an executive summary and background text, is important.

Report of Proposed SAR² Operational Procedures and Techniques: This report shall include proposed procedures, techniques and products that are developed with the potential operational users. Products shall include the following: search area selection; search map production; tracking of search and rescue resources; and analysis of search area coverage. The report shall include a review/critique provided by potential SAR² users.

<u>PDR for Upgraded SAR² Software Packages</u>: This documentation shall show the proposed software components at a preliminary design level to accommodate changes necessary to improve operations, implementation of state-of-the-art automatic target

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recognition, and migration to a work-station environment from a Cray Computer. The level of documentation must be sufficient for a preliminary design committee review. A final version of the documentation shall include changes accepted during the review process.

Report on New Concepts and Systems for Search and Rescue: This report shall include input from the civilian search and rescue community, the military, and the intelligence community who use remote sensing techniques. The input shall identify new concepts having a potential to improve search and rescue and disaster support operations. This report shall include a review/critique provided by potential SAR² users.

Indexes of Libraries: Library indexes shall include a technical explanation that assists in the identification and research procedures for information retrieval. For the current and archived NASA libraries pertaining to search and rescue, the indexes shall also include the technical description of the library maintenance function. Those national and international organizations with libraries containing information necessary for work of the Search and Rescue Mission Office, shall have the access description and the methods to search and retrieve data included as an appendix to the Indexes.

Seminar Preparation and Documentation: Knowledge of the documentation format, schedule and procedures of the national and international organizations holding seminars that are participated in by the Search and Rescue Mission Office, is necessary in order to maintain and oversee the resulting documentation. Summarized proceedings of specific seminars shall be developed during the meetings. The summarized proceedings must use knowledge of the search and rescue subjects, the relationship of the national and international organizations involved and the context of the discussions. Provide logistical support for seminars hosted by the Search and Rescue Mission Office. This shall include arrangement for translation services, accommodation of any unique needs of international guests and the location and booking of appropriate meeting places.

<u>Management</u>: Management will consist of objective and task identification, task delegation, monthly progress and status reports, responsiveness, daily coordination, staff management and the maintenance of an effective working relationship with the task monitor.

<u>Face-to-Face Status Meetings</u>: Meetings shall be held to discuss ongoing work and review daily/weekly task progress relative to established milestones. Problem areas that require special attention shall be reviewed and solutions proposed.

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<u>Formal Management Briefings</u>: The bi-annual briefings presented by the contractor shall include a review of the financial status of the task order, a review of current activities, problem areas, planned action to resolve problems, future plans, milestones and the status of deliverables.

<u>Technical Status Report</u>: Written status reports shall be submitted monthly. The reports shall include a statement of the task objective, a task summary (activities in progress) and the following information for each activity: (1) contractor's technical objectives for the month; (2) summary of work performed during the month; (3) analysis of work progress during the month; (4) current problems which may affect performance and corrective action; (5) summary of work planned for the next month; (6) conformance to milestone schedules; (7) documentation submitted to the task monitor during the month; (8) computer usage; and (9) non-local travel during the month.

MILESTONES/DELIVERABLES AND DATES:

- 1. Report on Advanced Sarsat Ground System 9/30/01
- 2. Report on Search and Rescue New Instrument Study 9/30/01
- 3. Report on Strategy for SAR² Radar Frequency Assignment 9/30/01
- 4. Report on GPRS Civil System Definition 9/30/01
- 5. RFI Mitigation Report for each occurrence on NOAA S/C 4 weeks after notification of problem
- 6. Report on Advanced Sarsat Communications 12/30/00
- 7. Report on new Complementary Remote Sensing Search and Rescue Systems 4/30/01
- 8. Report on Proposed SAR² Operational Procedures and Techniques 4/30/01
- 9. PDR for Upgraded Software Packages:
 - A. Motion compensation Review package 6/30/01; Final 7/31/01
 - B. Automatic Candidate Crash Site Selection with User Selectable State-of-the-Art Techniques Review Package 8/31/01; Final 9/30/01

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- C. Search and rescue personnel support products Review Package 10/31/00; Final 9/30/00
- 10. Report on New Concepts and Systems for Search and Rescue 4/30/01
- 11. Index of NASA Search and Rescue Library 6/30/01
- 12. Seminar Preparation and Documentation completed for review 30 days prior to required delivery date
- 13. Face-to-Face Status Meetings
- 14. Formal Management Briefings 3/15/01; 9/14/01
- 15. Technical Progress Report Monthly due the 15th of the month